

# **Cities in a “No-Regrets” Climate Strategy: Lessons From Transition Economies**

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**CITIES IN A “NO-REGRETS” CLIMATE STRATEGY:  
LESSONS FROM TRANSITION ECONOMIES**

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## FOREWORD

The Advanced International Studies Unit (AISU) of Battelle, Pacific Northwest National Laboratory developed a series of case studies to document an important trend: the emergence of cost-effective carbon mitigation opportunities in transition economies. The following report focuses on selected cases that relate to city-level approaches to mitigation. This research captures the essence of AISU's approach to environmental problem-solving. First, it addresses an actionable, global policy issue. It also focuses on policy tools that enhance economic well-being. Finally, it provides first-hand analysis from in-country experts in four nations: Poland, the Czech Republic, Russia, and Ukraine.

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## EXECUTIVE SUMMARY

The basis for the following assessment was a project in which ten technical and policy experts in Poland, the Czech Republic, Russia, and Ukraine were asked to evaluate a variety of no-regrets programs—programs that mitigated climate change while also realizing economic benefits—in their respective countries. A trend appeared during the collection of the case studies; many of the no-regrets “success stories” were taking place in cities.

Cities in transition economies are an attractive base for no-regrets programs for several reasons: some of the most cost-effective energy savings programs can be instituted by municipal governments; cities in transition economies now have the power to make decisions about investment projects without having to wait for permission from the central government; and cities have strong incentives to improve their economic and environmental health.

The cases reviewed in this assessment were divided into three categories. The first category focused on programs initiated by cities for cities. For example, Rovno, Ukraine, suffered from a problem common to many cities in transition economies: its inefficient street lighting system consumed large amounts of electricity and was very expensive to maintain. Local officials selected a state-owned enterprise, Miksvitlo, to replace traditional incandescent lamps with low-pressure sodium lamps. They used money from the lighting and maintenance budget to fund the project, and the project was accredited by a local bank. The savings from the project will pay for Miksvitlo’s work, and the pay-back period for the project is 4.5 years.

In Russia, the city of Chelyabinsk, has developed a plan to retrofit its district heating system that will save \$16.8 million over the next seven years. The project will also avoid producing 33,000 tons of carbon, or the amount produced by 15,500 U.S. households during the same period through electricity consumption. Savings from the Chelyabinsk city budget are being shifted away from heat subsidies and towards energy-saving improvements. As a result, consumers will be able to pay a larger share of their monthly bills, and the city will have more to spend on areas such as health care and education.

The second category consisted of city-based programs that were initiated at the federal level. Vratimov, a town in the Czech Republic, had a district heating system composed of 15 coal boilers. The city government received a grant from the Czech State Environmental Fund to upgrade their district heating system after realizing that they could save money and use less coal by using waste heat from a nearby factory. Vratimov now saves about 100,000 Gigajoules of energy per year, and each year Vratimov avoids using 1,200 metric tons of brown coal, 1,200 tons of coke, and other fuel.



Pyrzyce, a town of 14,000 in Northwest Poland, is investing in geothermal energy as an alternative to its current district heating system and realizing annual CO<sub>2</sub> reductions of 25,000 tons. Pyrzyce was able to undertake the project because of a World Bank loan and assistance from the National Fund for Environmental Protection and Water Management, a Polish federal agency.

A Czech federal air quality program, The Program on Healing the Atmosphere (PHA), has leveraged substantial climate benefits by providing loans and grants for climate-friendly municipal projects. The program has made a substantial contribution to improved air quality across the Czech Republic by providing cities with the means to convert their district heating systems from coal to natural gas.

The third category focused on other sources of funding for multi-city programs, such as international institutions and private foundations. For example, in Poland the European Union funded 17 training seminars on energy efficiency for municipal decision-makers to increase environmental awareness in small and medium-size Polish cities. The seminars attracted 978 participants from 215 different municipalities. As a result of the seminars, the Polish Network of energy Cities has become an active organization that will be able to continue training programs long after foreign funding for the program has disappeared.

In 1993, the Center for Energy Efficiency (CENef), a Russian non-governmental organization (NGO), used a grant from a U.S. foundation to launch the first Russian periodical dedicated to the field of energy efficiency. Today, 1,200 copies of *Energy Efficiency* are distributed in Russian, and city energy managers and other local officials form an important part of the bulletin's readership. The assessment found a positive trend: even the cash-strapped city and federal governments in transition economies will support no-regrets measures when the economic and social benefits of the projects are evident. In many cases, these programs are realizing carbon reductions that are as good or better than results from climate-centered projects. However, the cases also showed that serious obstacles to implementation persist. First among these was a shortage of capital for necessary investments. Lack of awareness and infrastructure were also serious barriers in several cases.

The findings from the studies have important implications for international climate change policy. Policy-makers should think carefully about how to provide sufficient incentives for projects focused primarily on climate change mitigation. In addition, developing country leaders should be made aware of the variety of approaches that are *already in place* around the world. Finally, effective policies will have to address financial barriers to implementation even when projects provide a competitive return on investment.

## INTRODUCTION

### Background

“No-regrets” measures<sup>1</sup> currently hold an important place in the debate surrounding effective, near-term climate change mitigation tools. Indeed, global no-regrets initiatives would seem to have several strong selling points. No-regrets measures minimize the economic impact of mitigation; in fact, they are designed to generate economic and/or social benefits that in turn make them attractive to host governments. Transition economies present one of the most promising arenas for these initiatives because the potential for near-term, cost-effective mitigation is so great: mitigation options in the region covered by these case studies--Eastern Europe and the New Independent States--are estimated to be nearly \$1.5 billion per year cheaper than similar reductions in western nations between 2005 and 2020.<sup>2</sup> However, many of these economically and socially beneficial projects go unrealized.

**Transition economies in Eastern Europe and the New Independent States contained only 15 percent of the world’s population in 1992 but generated 23 percent of the world’s CO<sub>2</sub> emissions. Just 3 years later, their share of emissions had fallen to 14 percent.**

### Approach

This case study project was designed to identify successful no-regrets programs and policies in transition economies. Four countries were chosen: the Czech Republic, Poland, Russia, and Ukraine.<sup>3</sup> Eligible cases were limited to programs or policies with an indirect effect on greenhouse gas emissions. Projects directed at greenhouse gas mitigation, such as joint implementation, are treated elsewhere in the literature<sup>4</sup>

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<sup>1</sup> A recent IPCC technical paper defines “No-regrets” as “Measures whose benefits--such as improved performance or reduced emissions of local/regional pollutants, but excluding the benefits of climate change mitigation--equal or exceed their costs.” (RT Watson, MC Zinyowera, and RH Moss, *Technologies, Policies and Measures for Mitigating Climate Change*; Intergovernmental Panel on Climate Change, 1996).

<sup>2</sup> See CN MacCracken, SL Legro, JA Edmonds, and WU Chandler, “Climate Change Mitigation Costs: The Roles of Research and Economic Reform” (1997), Pacific Northwest National Laboratory: DRAFT.

<sup>3</sup> Full reports for these four countries and China are available under separate cover.

<sup>4</sup> See M Evans (1995) *Joint Implementation in Countries in Transition: An Analysis of the Potential and the Barriers*, Pacific Northwest National Laboratory, Prepared for the U.S. Environmental Protection Agency under Contract PNL-10480.

Net greenhouse gas emissions from the four transition economies in the case studies have actually decreased since the IPCC base year of 1989. However, these emissions reductions have been due largely to traumatic economic restructuring. Russia's GDP dropped by 40 percent from 1990 to 1995, several hundred thousand miners were laid off in Poland, Ukraine experienced inflation in the four-digit range, and industrial production in the Czech Republic decreased by 36 percent from 1989 to 1995. Clearly, the emissions reductions associated with these reductions are not sustainable in any way. They resulted in economic and social hardship for the inhabitants of transition economies without doing anything to address underlying structural inefficiencies.

### **Figure 1. GDP and CO<sub>2</sub> Trends in Russia, 1991-1993<sup>5</sup>**

Figure 1 illustrates this phenomenon: because GDP in Russia fell more quickly than CO<sub>2</sub> emissions during the first years of restructuring and price reforms, the Russian economy actually became more carbon intensive, despite an overall reduction in net emissions.

### **Why Cities?**

There are several reasons to focus on no-regrets options at the local level. First, if one is interested in energy savings, some of the most cost-effective investments in energy savings can be made in cities. Steam traps, heat exchangers, efficient lighting, and other energy-saving products with a high rate of return have a natural market in city heating and lighting systems, in addition to municipal schools, hospitals, and other public buildings.

Another advantage is that most cities in transition economies now have the power to make decisions about investment projects without having to wait for permission from the central government. Furthermore, there are strong incentives for cities to improve their economic and environmental health. Cities in transition economies pay the energy bills for city-owned institutions from a very tight budget. Cities with inefficient district energy systems can spend up to one third of their entire operating budgets on subsidies for their residential heat and hot water. Finally, cities can be fined for air pollution in countries such as Poland and the Czech Republic, where enforcement of environmental laws has been strengthened.

### **The Case Studies Format**

The case studies approach moves from the realm of theoretical estimates of abatement potential into concrete projects that are presently offsetting and reducing greenhouse gas (GHG) emissions. Policy-makers from countries across the socioeconomic spectrum should know that no-regrets

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<sup>5</sup> Source: Goskomstat. Note that GDP figures in official statistics may overstate reductions in economic output, because Russia's "shadow economy" was not counted in official measures of GDP. While GDP measurements using purchasing power parity produce higher estimates, they also show a decline in output mirroring Figure 1.

programs can and do work. The diversity of the cases also highlights the flexibility of no-regrets approaches. In addition, the studies provide valuable insight into the factors contributing to a project's success or failure. Case studies of near-term measures also call attention to the economic windfall of emissions mitigation potential that exists in transition economies. Delaying action to 2020 would squander up to \$37 billion worth of low-cost mitigation options in the transition economies.<sup>6</sup>

Cases can also alert policy-makers to potential barriers before new no-regrets measures are designed and carried out. The following cases indicate where barriers were specific to the city or country and where they were related to program design or other cross-cutting variables.

## Methods

Local experts with experience in international climate change mitigation efforts served as “technical authors” in each country. Technical authors were also responsible for providing background data on energy, environment, and the economy for their respective countries. Furthermore, the technical authors also worked with a “policy author,” a high-ranking, local official willing to provide feedback and commentary on the findings. Policy authors had extensive experience in climate change policy; the authors in the Czech Republic and Poland serve as country representatives to the United Nations Framework Convention on Climate Change (FCCC), and the policy authors in Russia and Ukraine played leading roles in the U.S. Country Studies Program activities in their respective nations.<sup>7</sup> Table 1 lists the cases from each country that were included in this report.

**Table 1. Cases Studies Listed by Country**

Country	Cases
Czech Republic	National Program for Healing the Atmosphere State Environmental Fund Initiative: The Vratimov Waste Heat Program
Poland	Geothermal Energy in Pырzyce An Energy Management Training Program
Russian Federation	A District Heating Efficiency Program in Chelyabinsk Public Information Initiative: The <i>Energy Efficiency</i> Bulletin
Ukraine	Street Lighting Retrofits in Rovno

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<sup>6</sup> MacCracken et al., 1997.

<sup>7</sup>The U.S. Country Studies Program, which was announced by President Clinton in 1992, provides technical and financial support to 55 countries for climate change research.

## PROGRAMS INITIATED BY AND FOR CITIES

### Streetlighting Retrofits in Rovno, Ukraine

**Project Summary:** Rovno, Ukraine, suffered from a problem common to many cities in transition economies: its inefficient street lighting system consumed large amounts of electricity and was very expensive to maintain. Local officials selected a state-owned enterprise, Miksvitlo, to replace traditional incandescent lamps with low-pressure sodium lamps. They used money from the lighting and maintenance budget to fund the project, and the project was accredited by a local bank. The savings from the project will pay for Miksvitlo's work, and the pay-back period for the project is 4.5 years.

By the year 2000, energy consumption for street lighting in Rovno should be just half of what it was last year, when the project started. Annual power consumption in the system will drop from 6.8 million kWh/yr to 3.2 million kWh/yr after the retrofits. These retrofits will also allow the city street lighting enterprise to reduce its installed capacity by 1,220 kW without compromising on the quality of light. Since it began last year, the project has already saved approximately 1 million kilowatts at a cost of \$60,000.

The project also has environmental benefits -- in addition to reducing electricity (and, therefore, fuel consumption and greenhouse gas emissions), the use of sodium lamps will reduce the mercury content of the lamps by 95 percent.

**Approach:** The Rovno project replaced 150-watt and 200-watt incandescent lamps and 250-watt and 400-watt mercury lamps with sodium lamps, which come in 70-, 100-, 150- and 250-watt varieties. Replacing the incandescent and mercury lamps with sodium lamps is expected to reduce final electricity consumption in the city's lighting network by an average of 53 percent. Miksvitlo, a state-owned enterprise in the city of Rovno, was selected by the local government to implement the project.

The total cost of the Rovno street lighting is about \$1.23 million over six years. The pay-back period for the investment has been calculated at 4.5 years. Following the retrofit, the energy intensity of the average fixture in the system will drop from 225 watts/unit to 106 watts/unit. In addition, project managers estimate that the average annual maintenance costs per fixture will decrease from \$57 before the project to \$51 after the project.

Financing for the project is needed only in its initial stages; the main source of financing is generated from the savings from the efficiency measures proposed in the project plan and additional savings from lower maintenance costs. In other words, the Rovno street lighting system will be retrofitted using money that would have been spent on outdoor city lighting using

the existing equipment. Initial funding was provided by the Rovno local government, and the

project received accreditation from a commercial bank.

Initial project benefits include a considerable reduction in energy consumption for lighting; improved lighting quality that will meet city standards for illumination levels; a reduction in costs for lighting network maintenance; a reduced risk of mercury contamination from damaged lamps (the mercury content in current lamps is more than 10 times that of the newer sodium models); and a reduction in GHG emissions due to the significant electricity savings generated by the more efficient lamps. Annual electric power savings of up to 3.6 million kWh translate into GHG emissions reductions for the program that are expected to total 270 metric tons of carbon.

### **Lessons Learned:**

- ***Mitigation projects like the street lighting retrofit can benefit local development.*** Rovno officials have contacted a factory in nearby Poltava about purchasing sodium lamps from them in the future. This factory, the Gaseous-Discharge Lamp Plant, is developing a new type of sodium lamp with no mercury content whatsoever; the eventual use of these lamps could allow Rovno to retire all lamps containing mercury from service. This agreement will provide jobs to workers in Poltava and help the plant to create a product that can be exported. No Ukrainian company currently makes the light bulbs. However, Rovno will be saving so much money from the project that it is still profitable for the city to import the bulbs in the interim.
- ***Local governments can take advantage of increased autonomy.*** All local governments in Ukraine have the authority to implement similar projects, since they no longer need to receive permission from regional or federal authorities. The primary barrier to expanding the project into other cities and regions is the problem of identifying sufficient initial funds to get the projects started.
- ***Even ordinary cities in a difficult economic climate can finance energy-savings projects.*** Cities may find that they are able to finance projects from budgetary savings when they also pay the energy bills. The Rovno project is worth studying precisely because Rovno is not unique, or in any way a “showcase” city.

### **District Heating System Modernization in Chelyabinsk, Russia**

**Project Summary:** Chelyabinsk, Russia, has developed a plan to retrofit its district heating system that will save \$16.8 million over the next seven years and avoid adding at least 33,000 tons of carbon to the atmosphere. Savings from the city budget are being shifted away from heat subsidies and towards energy-saving improvements. As a result, consumers will be able to pay a larger share of their monthly bills, and the city will have more to spend on areas such as health care and education.

**Background:** The Metallurgichesky District is an industrial neighborhood that is home to

approximately 145,000 residents of Chelyabinsk, a Russian regional capital. The economic situation in the district is fairly indicative of the difficulties facing Russia as a whole. In 1995, industrial output decreased by 22 percent, resulting in losses of \$877 million. The Metallurgicheskyy District has its own centralized heating system; 24 schools, 65 nurseries, 9 hospitals, and many households depend upon this system for their heat and hot water.

Heat distribution is handled by the factory and *Remzhilzakazchik*, the municipally-owned housing authority. The costs of heat and hot water in the district have ballooned to 34 percent of the entire municipal budget of Chelyabinsk. The Metallurgicheskyy District alone received at least \$13 million in 1996 in the form of heat and hot water subsidies to housing estates and public buildings. As a result, the combination of heating supply costs and subsidies have become the most serious economic problem in the district. Quality of heating is another pressing issue; there is currently no reserve heat source in the district, and underheating is a serious problem with temperatures are at their lowest.

**Approach:** The Russian project participants in the Metallurgicheskyy District project are a non-governmental organization (The Center for Energy Efficiency, or CENEf), regional and district governments, and local experts. The initial stages of the project were funded by Battelle, Pacific Northwest National Laboratory under a contract with the U.S. Department of Energy.

CENEf conducted a series of energy audits at central heating points, pipelines, and buildings in early 1996 and drafted a feasibility study to identify cost-savings linked to various measures. For example, auditors recommended installing heat meters at mains; automated controls for gas boilers; adjustable speed drives for motors running the pumps; insulation for pipes, and heat meters and thermostats at the end-use points. None of these measures required considerable up-front investment or costly reconstruction of existing pipelines.

The city was impressed by the recommendations and agreed to commit money from the municipal budget to the program (see Table 2 below). Their expenditures will be outweighed by the savings from reducing the burden of heat and hot water subsidies to housing estates, schools, and health care facilities. The city also received the plan favorably because it provided positive cash flow even in the first year of the project. Savings from the project will also have a favorable impact on households. Monthly bills for heat and all types of water for families in the district

will be approximately 29 percent lower in 2003 as compared to the full cost of these services in 1997.

At the current stage of the project, it would be premature to make any authoritative pronouncements about the final environmental impact of the project. However, the measures included in the housing authority component of the project are expected to result in annual reductions of 33,000 to 44,000 tons of carbon as the results of saving 1,000 to 1,400 PJ of heat and 500,000 to 700,000 kWh of electric power.

**Table 2. Project Impact (in U.S. dollars)**

Year	Total Savings	Debt Service	Employee Incentives	Investments from City Budget	Net Savings to Housing Authority	Net Savings to City Budget
1997	1,237,379	-171,120	51,718	759,123	167,557	430,101
1998	2,552,736	-217,767	75,770	1,217,521	374,563	1,102,649
1999	3,424,697	-217,767	75,770	940,038	550,301	2,076,355
2000	4,314,955	-46,647	75,770	935,892	726,176	2,623,764
2001	4,471,929	-46,647	75,770	0	883,150	3,559,656
2002	4,471,929	0	75,770	0	883,150	3,513,009
2003	4,471,929	0	75,770	0	883,150	3,513,009
<b>Total</b>	<b>24,945,554</b>	<b>-699,948</b>	<b>506,338</b>	<b>3,852,574</b>	<b>4,468,047</b>	<b>16,818,543</b>

**Lessons Learned:** The Chelyabinsk project has already become a blueprint for officials in other Russian cities who are interested in implementing and financing energy efficiency measures.

- ***No-regrets programs can take advantage of consistent infrastructure across cities.*** District heating systems in Russian cities with populations greater than 10,000 have a nearly identical layout. More than 1000 cost-effective projects like the one in Chelyabinsk could be implemented in Russia, with potential annual energy savings reaching 45 to 60 million Gigacalories. They could also leverage reductions of up to 10 to 20 percent of current greenhouse gas emissions in Russia, or 6 to 8 million tons of carbon.
- ***Information is critical to success.*** Major barriers included a lack of statistical data on the heat supply system, the reluctance of the organizations involved to apply new technologies, and a lack of expertise among system staff in business planning and project development in a market environment. Information from the audits eventually helped to win the support of key decision-makers.
- ***“Economic” projects can have a strong impact on quality of life.*** The heating season in Chelyabinsk lasts for about 218 days annually, with an average temperature during this period of 19°F. The lowest temperature during this time is approximately -26°F in January, and a reliable heat supply is absolutely necessary for a normal life. Improvements to the heating system will bring more heat to Chelyabinsk apartments in the winter.



## FEDERAL INITIATIVES FOR CITIES

### A Waste Heat Energy Project in Vratimov, Czech Republic

**Project Summary:** Vratimov is an industrial town in the heavily-polluted “Black Triangle” region of Northern Moravia. Vratimov had a district heating system comprised of 15 coal boilers that supplied heat to about one third of the town’s homes and a number of stores. The city government decided to apply for a grant from the Czech State Environmental Fund to upgrade their district heating system. They found that they could save money and use less coal by using waste heat from a nearby factory.

Vratimov now saves about 100,000 Gigajoules of energy per year. It also avoids a great deal of pollution from fuels. For example, each year Vratimov avoids using 1,200 metric tons of brown coal, 1,200 tons of coke, and other fuel. In addition to reducing particulate emissions by almost half, sulfur dioxide levels are 70 percent of what they were before the project. There are even climate benefits: the project will reduce CO<sub>2</sub> emission by 10,000 tons.

The most obvious benefit for Vratimov is environmental. Previously, coal boilers released smoke and ash from chimneys that were 15 meters high -- not as tall as some of the taller apartment buildings. As a result, the center of town was dark and dirty during the winter. The waste heat system has shut down these boilers and has made the center of town a more pleasant place.

**Background:** The Czech State Environmental Fund (SEF) uses fines from polluters to fund environmental projects. SEF projects focus on air, water, soil, and conservation/biodiversity. Approximately \$20 million has been earmarked annually in the form of grants and loans from the fund for environmental protection projects.

Vratimov received a loan to conduct the work, and they formed a limited liability company to generate and distribute the heat. While the initial investment costs were fairly high, operating expenses are relatively low. In addition, the city installed heat meters and hot water meters in apartments, so they expect additional reductions in energy consumption as consumers begin to see monthly utility bills that correspond to the amount of heat and water that they actually use.

**Approach:** The goal of this project was to substitute 15 coal boilers and an old gas boiler with a new district heating system in Vratimov, a small town in Northern Moravia. The total installed capacity of the district heating system will be 16 MW, which covers maximum projected demand for heat with a substantial reserve. Most of the heat for the district heating system now comes from waste heat generated at the Nová Hut steel factory in the city of Ostrava. This heat previously escaped unused into the atmosphere, and hot water from the factory had to be cooled in the factory’s cooling towers. Funds were used to install heat exchangers in the rolling mill and buildings, pumping stations, 3.9 km of arterial pipes, and meters and controls. Total investment

was \$2.8 million in 1995 prices.

The district heating system is owned and operated by the Teplo Vratimov, a limited-liability company established in February 1995 by the town of Vratimov and the joint stock company that owns the Nová Hut factory. Teplo Vratimov is responsible for the construction and operation of the system, as well as for the purchase and distribution of heat in the town. The town and Nová Hut each own a 50-percent stake in Teplo Vratimov. Roughly 80 percent of the heat demand is met by the waste heat from the rolling mill at Nová Hut. During work interruptions at the mill, the heating plant at Nová Hut will cover system demands.

The estimated investment costs of the entire project totaled \$2.8 million. The investment cost per amount of heat consumed each year is \$37/GJ with sales of 75,000 GJ, or \$55/GJ with sales of 50,000 GJ. While initial investment was relatively high compared to other methods of supplying heat, the project has relatively low operating expenses. The cost of supplying heat at Vratimov (including project financing costs and interest on loans) is approximately \$15/GJ (in 1996 prices), even assuming a 3.5 percent annual price increase.

The project also reduces primary energy consumption by approximately 100,000 GJ in the form of 1,800 tons of black coal; 1,200 tons of coke; 1,200 tons of brown coal; and 100,000 m<sup>3</sup> of natural gas (1994 data). Particulate emissions have decreased to 55 percent of their pre-project levels, and SO<sub>2</sub> and NO<sub>x</sub> emissions are 70 percent and 60 percent of their pre-project levels, respectively. CO<sub>2</sub> emissions reductions are summarized in Table 3 below.

**Table 3. Annual Reduction of CO<sub>2</sub> Emissions from Various Sources due to the Vratimov Waste Heat Project.**

<b>Fuel</b>	<b>Amount Reduced</b>	<b>Corresponding CO<sub>2</sub> Reduction</b>
Black Coal	1,800 metric tons/year	4,800 metric tons/year
Coke	1,200 metric tons/year	3,400 metric tons/year
Brown Coal	1,200 metric tons/year	1,300 metric tons/year
Natural Gas	100,000 m <sup>3</sup> /year	200 metric tons/year
<b>Total</b>	--	<b>9,700 metric tons/year</b>

#### **Lessons Learned:**

- *No-regrets measures can have a major impact on local environmental quality.* Vratimov, with its 6,800 inhabitants, lies on the northern edge of the Frýdek-Místek district, home to some of the worst air pollution in the entire Czech Republic. Vratimov itself is one of the two most polluted areas in the Frýdek-Místek district.<sup>8</sup> The difference in air quality during the

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<sup>8</sup> Czech Hydro-meteorological Institute. *Database of air polluting energy sources*. REZZO 1. Prague: Prague: CHMÚ, 1993.

heating season is obvious to Vratimov's residents.

- ***International project developers should consider leveraging the infrastructure in existing programs.*** The SEF has many additional projects that could be implemented if there were more money. In fact, the growing number of completed projects to protect the environment has reduced the number of polluters paying fines into the SEF and reduced the fund's capital.
- ***Subsidies may actually undercut local investment in climate-friendly projects.*** Heat subsidies to Czech household and heating supply companies are some of the most serious barriers to replicating projects such as the one in Vratimov. Currently, the federal government directly subsidizes owners of residential buildings for heat. However, there is a way to overcome this barrier; there are now proposals calling for the gradual elimination of these subsidies over a three-year period. The elimination of subsidies would be coordinated with the introduction of social support programs targeted at individual households. Other means of encouraging investment in efficient district heating systems include direct subsidies for investment costs, grants to close the interest rate gap for commercial credit sources, and guarantees to help with obtaining commercial credit.

## **Geothermal Energy for Pyrzyce, Poland**

**Project Summary:** Pyrzyce, a town of 14,000 in Northwest Poland, is investing in geothermal energy as an alternative to its current district heating system and realizing annual CO<sub>2</sub> reductions of 25,000 tons. Pyrzyce was able to undertake the project because of a World Bank loan and assistance from the Polish Geothermal Association.

**Background:** Poland has a long tradition of using its geothermal waters, but until recently their use was limited to therapeutic purposes. This use was expanded in the late 1980s when a geothermal energy program was launched. A special company, the Polish Geothermal Association (PGA), was then created to oversee geothermal energy development. The PGA assesses geothermal potential in Poland and works with other institutions to design complete plants with heat distribution systems. PGA projects have been financed with the Polish federal funds (via the Committee for Scientific Researches and National Fund for Environmental Protection and Water Resources) and World Bank loans.

**Approach:** The geothermal heat plant in Pyrzyce (near the German border), in the north-west part of the Polish Lowlands Geothermal Province was completed in 1996. Heat is extracted from water in Liassic formations in two wells. The geothermal heating system of 50 MW, which works in conjunction with gas boilers in peak season, serves approximately 14,000 inhabitants.

The geothermal heat plant in Pyrzyce cost \$8 million, and the cost of the district heating system was \$8.8 million. The pay-back period for this investment has been estimated at 6 years. A total

of 25,000 metric tons of CO<sub>2</sub> will be reduced because of Pyrzyce's switch to geothermal energy and approximately 30,000 metric tons will be reduced by using the gas boilers during peak periods. Another major environmental benefit of the project was a reduction in air pollution due to the use of a clean fuel. Estimates indicate that the district heating system in Pyrzyce offsets 190 metric tons of SO<sub>2</sub> and 50 metric tons of NO<sub>x</sub>.

### **Lessons Learned:**

- ***Profitable renewable energy projects are easily overlooked.*** Geothermal water has been studied in four geothermal provinces in Poland, and an estimate of Poland's geothermal energy reserves is provided in the table below. Poland's three geothermal regions cover 6,682 km<sup>3</sup> and contain heat reserves equivalent to 34,727 million tons of oil. Geothermal energy potential for Poland as a whole is estimated at 40 PJ/year, or approximately 6 percent of total heat consumption. In 1993, an experimental geothermal heat plant was completed in Banska - Bialy Dunajec in the Podhale sub-basin of the Carpathian province. Hot water from the heat exchanger is delivered to greenhouses, wood drying facilities, and heating systems for almost 200 farmers in the area. Heat exchangers and distribution pipelines will eventually be constructed in order to supply hot water to four townships and approximately 70,000 potential customers.
- ***Subsidies may prevent the renewable energy market from reaching its potential.*** District heat is still subsidized in Poland. After energy markets are fully liberalized, the geothermal energy may well become a competitive supply option in the heating sector. If the external, environmental costs were taken into account, geothermal energy would be considered advantageous even in current energy markets. In the meantime, subsidies totaling 30 percent of investment costs are required to make geothermal plants cost-effective in comparison to traditional heating systems.
- ***Capital can be a problem even in profitable investment projects.*** In addition to subsidies for heat from fossil fuels, the other major barrier facing geothermal projects has been a lack of investment capital for project development. According to the Polish government, this lack of capital was the primary reason why geothermal energy was not considered until recently as a viable heating resource. The catalyst necessary to change the situation and move projects forward came in the form of a loan from the World Bank.

### **A Program for Healing the Atmosphere in the Czech Republic**

**Project Summary:** A Czech federal air quality program, the Program for Healing the Atmosphere (PHA), has leveraged substantial climate benefits by providing loans and grants for climate-friendly municipal projects.

**Background:** On July 9, 1994, the Czech parliament decided to free part of the resources of the State Property Fund for use in reducing regional pollution by improving the quality of the

atmosphere in cities and municipalities. The PHA was created to accomplish these purposes. The program was not designed to support climate-related goals, but GHG reductions have been realized as a secondary benefit of program-related activities. About 60 percent of the funds at the PHA's disposition are used for grants; the remainder are used for loans. Any legal entity can apply for support from the PHA, including municipalities, cities, and associations of towns.

Cities are eligible for loans when they apply for support for activities of a commercial nature. The PHA loans are interest-free, with a maximum term of 5 years. Payments can be put off for up to 5 years, but the total period of time from approval to payment must not exceed 7 years. Loans are offered for up to 70 percent of project costs and can be offered concurrently with subsidies. Applicants must prove, however, that they are capable of covering at least 20 percent of the project costs from their own or other sources.

Acceptable projects include fuel-switching, connection to the gas grid, cogeneration, and other "clean" sources of heat and hot water supply to households. Priority is given to projects with a high ratio of pollution reduction to capital investment, projects that decrease emissions to a level well below permissible limits, and projects that complement regional energy and environmental initiatives.

Approximately 95 percent of the PHA's money has been spent to help Czech municipal governments convert to natural gas heating. Specifically, finances are being steered towards the construction of medium- and low-pressure pipes for natural gas. Approximately \$7 million has also been earmarked for the repair of small domestic boilers, providing sums of up to \$700 per boiler to be distributed by municipal offices.

The PHA has had a very positive impact on air quality in towns throughout the Czech Republic by reducing emissions of common pollutants substantially. CO<sub>2</sub> emissions are not monitored in the PHA, and it is difficult to calculate reductions from existing information on the recipients of loans and grants. However, rough calculations can be made, because 90 percent of the activities supported by the PHA replace the brown coal used in small combustion units with natural gas. The heating values of the two fuels (brown coal, 14 GJ/ton; natural gas, 33 GJ/thousand m<sup>3</sup>) and emission coefficients for CO<sub>2</sub> emissions (brown coal, 101 kg/GJ; natural gas, 56 kg/GJ) result in the CO<sub>2</sub> emissions reductions present in Table 4 below.

**Table 4. Estimate of Climate Benefits from the PHA Program**

	1997	1998	1999	2000	Total
<b>Increase in Natural Gas Consumption</b> (million m <sup>3</sup> /year)	400	900	1,400	1,600	--

<b>Annual Reduction in CO<sub>2</sub> Emissions</b> (metric tons/year)	594,000	1,336,000	2,079,000	2,376,000	6,385,000
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### Lessons Learned:

- ***Fuel-switching projects offer substantial emissions reductions in the near term.*** Judging from the size of the market for fuel conversion, the PHA program could be expanded to two or three times its size. The State Administration's "Outline of Considerations for Climate Change" estimates that the amount of CO<sub>2</sub> emissions reduced as a result of the program totals approximately 10 percent of those emissions reduced as a result of fuel switching in the heating sector. This reduction constitutes approximately 30 percent of all possible cost-effective reductions from fuel switching until the year 2000.
- ***Cities can be good creditors.*** Most projects cover 40 percent of their costs with loans and 40 percent through direct grants, and no problems with loan payments have emerged.

## INTERNATIONAL AND NON-GOVERNMENTAL INITIATIVES FOR CITIES

### A Training Project for City Energy Managers in Poland

**Project Summary:** The European Union funded 17 training seminars on energy efficiency for municipal decision-makers throughout Poland in order to increase environmental awareness in small and medium-size Polish cities. The seminars attracted nearly 1,000 participants from 215 different municipalities. As a result of the seminars, the Polish Network of Energy Cities (PNEC) has become an active organization that will be able to continue training programs long after foreign funding for the program has disappeared.

**Background:** About 50 percent of Poland's potential for energy savings can be found in small and mid-sized cities. Municipal governments have the authority to make decisions affecting these savings, but they frequently lack an awareness of the modern energy management methods necessary to capture them.

**Approach:** The European Phare-TEMPUS<sup>9</sup> program organized a series of energy efficiency seminars involving in-country organizations (PNEC, the Polish Foundation for Energy Efficiency, and three Polish universities) and several international agencies (the European Energy Cities Network and French and Portuguese environmental agencies). The seminars focused on energy planning at the municipal level, options for financing energy efficiency, energy saving in lighting, and heat-saving potential in buildings. The majority of the instructors were Polish graduates of one of three previous in-country TEMPUS training programs.

The entire project cost \$100,000, which covered expenses for 204 lectures and administrative costs. Although this was a relatively small sum considering the scope and potential effects of the project, it would have been extremely difficult to find an in-country sponsor for the project. Energy and climate benefits have been difficult to quantify, but there has been a sharp increase in the membership of the PNEC from 9 to 31 members. This growth will allow PNEC to continue training using its own fund-raising capacity and teaching potential.

### Lessons Learned:

- ***Information and training programs are an important accompaniment to project-based mitigation efforts.*** Although it is difficult to measure changes in the level of environmental awareness according to a quantitative definition, there is no doubt that most of the trainees

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<sup>9</sup> Phare-TEMPUS: The Phare Program is an assistance program for Eastern European countries that was established in December of 1989 by the Council of Ministers of the European Union; the acronym referred to the program's original directive (Polish-Hungarian Assistance in Restructuring of Economy). TEMPUS stands for the Trans-European Co-operation Scheme for Higher Education, a multi-country initiative under Phare.

acquired knowledge enabling them to better understand and define energy efficiency issues. This in turn has generated new energy-savings projects at the municipal level, such as demand-side management projects in four cities and efficient lighting projects in at least five cities.

- ***A multi-city program can reduce expenses by sharing costs among many stakeholders.*** Even cost-effective and inexpensive projects such as TEMPUS can be left unfunded in Poland, since funding must be allocated to urgent concerns, such as health services, primary education, and national security. For this reason, external financing was very important for the project. As the Polish economy recovers from the recession, the structures created with help of PHARE and other similar funds will be able to be sustained with the use of increasing in-country financial resources.
- ***Training programs can create a regional base of expertise.*** PNEC is currently seeking support to extend its present training project to Ukraine. Representatives of the city of Lvov who participated in two of the TEMPUS seminars have expressed strong interest in these efforts, as have city officials from elsewhere in Ukraine and Lithuania.

### **An NGO Newsletter on Energy Efficiency in Russia**

**Project Summary:** In 1993, the CENEf, a Russian NGO, used a grant from a U.S. foundation to launch the first Russian periodical dedicated to the field of energy efficiency. Today, 1,200 copies of *Energy Efficiency* are read by government officials, utility experts, industrial energy managers, and investors.

**Background:** Regional officials in Russia face significant growth of energy costs in the structures of regional budgets and do not know what might be done to reduce it. A lack of experience with market conditions, combined with a shortage of information about what is being done in other regions, has led to costly delays and mistakes in program development.

*Energy Efficiency* includes energy efficiency policy news, updates on new technologies and projects, articles on potential business partners, statistics, and other information. Currently, 1,200 copies of the bulletin are published in Russian-- more than double the print run of the inaugural issue. *Energy Efficiency* subscribers in Russia include the federal government, regional energy commissions, regional utilities (heat and power), all Russian energy centers and agencies, R&D institutes, and other organizations. CENEf's Russian readership is higher than its circulation would imply, because for each institutional subscriber in Russia, several people actually read the bulletin. In addition, 350 copies are translated and published in English. *Energy Efficiency* is distributed free of charge in Russia, surrounding nations, the United States, Western Europe, India, China, and other countries. It has also been widely available at domestic and international meetings dealing with energy efficiency and climate change.

Annual costs for CENEf to produce and distribute the Russian and English versions of *Energy*



*Efficiency* total approximately \$30,000, which has been provided by a grant from the John D. and Catherine T. MacArthur Foundation. The benefits are significant: 3 to 5 readers per day contact CENef to get additional information on various articles. In many cases, readers from regions have decided to establish contact with CENef or launch an energy efficiency project after reading *Energy Efficiency*.

*Energy Efficiency* has also been an important tool for influencing policy. Energy sector decision-makers often use the information from the bulletin in their activities. For example, CENef developed a draft of the Law on Energy Efficiency that was published in an issue of *Energy Efficiency*. This draft law was then used as a model for regional regulations in the Tula and Chelyabinsk regions. Information on efficient building codes developed for Moscow initiated similar developments in a number of regions, a phenomenon that led in turn to the implementation of new construction technologies and the creation of new markets.

### **Lessons Learned:**

- ***Demand for information on energy efficiency programs far exceeds supply.*** CENef's project could be expanded greatly, and its mailing list could be broadened to other former Soviet republics with significant numbers of Russian speakers. *Energy Efficiency* has already been used as a model for similar publications that have been launched in Russian regions. There is also a demand for niche publications. *Energy Manager*, a new Russian-language quarterly, focuses on senior energy managers at industrial enterprises.
- ***Energy and environmental periodicals can also serve as an effective means of disseminating information about climate policies and programs.*** *Energy Efficiency* has educated its readers about domestic and international activities under the United Nations Framework Convention on Climate Change (FCCC). The bulletin reaches certain audiences, such as Russian entrepreneurs and regional policy-makers, who might not ordinarily receive climate policy information.

## CONCLUSIONS

### Findings

***Successful municipal projects share common features.*** Cities with successful projects have several things in common. First, project developers spent time gathering and presenting information. This preparation was especially useful because it allowed them to develop alternatives to scale the program up or down depending upon how much funding was available. This preparation was also critical in convincing officials to invest municipal budgetary funds in a project. Second, the programs provided clear incentives for stakeholders. PHA program participants in the Czech Republic stood to benefit from loans and grants to support air quality, but they also faced fines if they did not comply with emissions limits. Third, cities with effective no-regrets initiatives were able to be innovative. In some cases, this innovation was expressed by finding a local enterprise that was willing to become involved in a project, such as the Nova Hut company in Vratimov. Other times, innovation involved capitalizing upon a non-traditional source of energy, such geothermal energy in Pyrzyce.

***A broad variety of programs with mitigating impacts are already in place.*** One surprising finding was the number and variety of no-regrets programs already in place in transition economies. Stakeholders included government agencies, non-governmental organizations, and private industry. There was also a diversity in the focus of the measures, ranging from energy supply and demand to environmental protection. While few if any of the cases studied considered climate considerations in their design and implementation, greenhouse gas mitigation benefits from the projects compared very favorably with climate-focused projects assembled under the United States Initiative on Joint Implementation (USIJI). Table 6 provides rough working estimates of annual CO<sub>2</sub> savings where available.

**Table 6. CO<sub>2</sub> Impacts of Case Projects Where Rough Estimates Were Available**

<b>Project</b>	<b>Estimated Annual CO<sub>2</sub> Reductions (in metric tons)</b>
Rovno Street Lighting Project (UKR)	270
Vratimov Waste Heat Recovery Project (CZR)	19,200
Geothermal Energy: Banska-Bialy Dunajec and Pyrzyce (POL)	29,300
Chelyabinsk District Heating System Upgrade (RUS)	33,000-44,000
Geothermal Energy: Banska-Bialy Dunajec and Pyrzyce Project <i>including</i> Fuel Switching (POL)	59,300
State Energy Efficiency Grants Program (CZR)	328,000
Program for Healing the Atmosphere (CZR)	399,000

***Federal and local governments in transition economies are willing to devote funds to programs and policies with climate change mitigation benefits.*** This commitment was evident both in countries with relatively healthy economies, such as Poland, and in countries with more serious economic difficulties, such as Ukraine. It should also be noted that start-up funding from organizations such as the U.S. Agency for International Development or their European counterparts was occasionally necessary when the economic benefits of a project were not immediately apparent.

***Certain obstacles to implementation appeared consistently across projects and countries.*** The single greatest obstacle to implementation or expansion of successful projects was a lack of financing. In part, this explains the bias towards state-funded projects in energy and environment; the commercial cost of capital in transition economies is frequently too high for individual investors or companies, even when the rates of return on projects would make them competitive in Western economies. For this reason, some experts have suggested government subsidies to defray the costs of commercial financing or state-backed loan guarantees to meet requirements for lending from multilateral development banks and export credit agencies.

Prohibitively high interest rates provide a glimpse of why major energy and economic savings go unrealized. Projects that would generate larger benefits for lower costs than in the United States are rendered infeasible because of the scarcity, and expense, of capital in these economies.

Another significant obstacle to program implementation and expansion was a lack of awareness among potential project beneficiaries. For this reason, projects aimed at improving awareness among key audiences, such as municipal officials, observed a number of spill-over benefits.

## **Recommendations**

No-regrets experiences in cities provide lessons that should be weighed carefully in the development of any future climate policy strategy involving countries that are not members of the Organization for Economic Cooperation and Development (OECD). Findings from the cases would suggest the following recommendations for integrating “no-regrets” measures into future policy agendas.

1. ***U.S. policy-makers should think carefully about how to provide sufficient incentives for project implementation.*** Experience with no-regrets measures in the transition economies has shown that perceived climate benefits alone were not enough to motivate local decision-makers. However, the cases also demonstrated that when economic and social benefits were evident, even cash-strapped municipalities were willing to commit resources to projects.

2. ***U.S. policy-makers should make officials in countries with no-regrets program potential aware of the broad variety of approaches and the multiple social and economic benefits that can be gained from these measures.*** Rather than viewing a proposed no-regrets requirement as a burden, leaders in target countries should view the process as an opportunity to realize concrete gains while also fulfilling proposed requirements for the Framework Convention on Climate Change (FCCC) protocol.
3. ***U.S. policy-makers should understand that serious obstacles to implementation exist even when projects appear to be profitable.*** Overcoming a lack of awareness will be crucial to the success of any no-regrets initiative. In addition, cases from transition economies indicate that financing will have a substantial impact on the number of projects or policies that can be implemented.

## Appendix I. List of Abbreviations Referred to in the Mitigation Case Studies

### ***Organizations:***

ADEME	French <i>Agence de l'Environnement et de la Maitrise de l'Energie</i>
CEA	Czech Energy Agency
CEETA	Portuguese Center for Studies in Economics and Energy of Transportation and Environment
CSP	U.S. Country Studies Program
CENEF	Center for Energy Efficiency (Russia)
EC	European Community
FEWE	Polish Foundation for Energy Efficiency
GEF	Global Environmental Facility
GREENTIE	Greenhouse Gas Technology Information Exchange
IEA	International Energy Agency
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
ME	Ministry of Environment
MIT	Ministry of Industry and Trade (Czech Republic)
NIS	New Independent States (the 15 former Soviet republics)
NFEPWM	National Fund for Environmental Protection and Water Management
OECD	Organization for Economic Cooperation and Development
PGA	Polish Geothermal Association
PHARE	Polish - Hungarian Assistance in Restructuring of Economy
PNEC	Polish Network of Energy Cities
SEF	State Environmental Fund (Czech Republic)
TEMPUS	Trans-European Cooperation Scheme for Higher Education (EC Programme)
UCPTE	Union of Coordination of Production and Transmission of Electricity (Poland)
UMM	University of Mining and Metallurgy (Kraków, Poland)
UN	United Nations
USAID	United States Agency for International Development
USIJI	U.S. Initiative on Joint Implementation

### ***Other:***

AIJ	Activities Implemented Jointly
CFL	Compact Fluorescent Lamp
CHP	Combined Heat - Power
DH	District Heating
DSM	Demand Side Management
ESCO	Energy Service Company
FCCC	(United Nations) Framework Convention on Climate Change
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GJ	Gigajoules ( $1 \times 10^9$ joules)
IRP	Integrated Resource Planning
IRR	Internal Rate of Return
JI	Joint Implementation
mnt	Million metric tons (1 ton carbon = 1 Megagram carbon)
Mtoe	Million tons of oil equivalent
PHA	Program on Healing the Atmosphere (Czech Republic)
PJ	Petajoules ( $1 \times 10^{15}$ joules)



## **Appendix II. Background Information on Mitigation Case Study Countries**

### **The Czech Republic**

The Czech Republic signed the FCCC in October 1993. The first National Communication of the Czech Republic for the Framework Convention on Climate Change was submitted in September 1994. The Czech Republic agreed in the materials it submitted to undertake efforts to reduce GHG emissions and to meet the requirement of stabilizing emissions at or below 1990 emissions levels by the year 2000.

Meeting this goal appears viable primarily because of a sharp downturn in the economy, and subsequently in emissions levels, in 1990. The emissions estimates given in the National Communication have been confirmed by several additional projections.<sup>10</sup> All of the studies reach the same conclusion: at present levels of economic growth, levels of greenhouse gas emissions in the Czech Republic by the year 2000 will be at least 10 percent below 1990 levels.

Projections of rapid economic growth, which began to appear two years ago, increasingly appear overoptimistic. Although there have been several changes that might affect emissions levels, such as delays in the completion of the Temelín nuclear power plant, they do not threaten compliance with the Czech FCCC obligation for the year 2000. It is expected that any concerns about failure to meet the specified levels for the year 2000 will disappear definitively by the end of 1997.

These findings have had both positive and negative effects on the position of the Czech Republic on emissions reduction issues. On one hand, they have enabled the country to take an active role in international negotiations and cooperation, since meeting IFCC obligations does not pose any additional demands on the state budget. On the other hand, the Ministry of the Environment has lost any basis for justifying the inclusion of emissions reduction programs in the state budget, since the primary mandate of the convention can be met without them. The Czech Republic is currently considering measures which could result in an average annual reduction of 3.3 million tons of CO<sub>2</sub>. The majority of these reductions would be gained through changes in the system of energy taxes.

### **Poland**

Poland's economic fortunes were similar to those of other transition economies in the late 1980s and early 1990s: decreasing GDP and rapidly rising inflation and unemployment. The effects of this economic crisis were evident. Between 1989 and 1993, primary energy consumption in industry fell by 28.1 percent. A total of 27.3 percent of this decrease stemmed from a reduction in industrial output and 1.9 percent resulted from restructuring. During the same period, however, there was also an increase of 1.1 percent in energy consumption due to lower energy efficiency.

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<sup>10</sup> Czech Ministry of Industry and Trade (1996) *Energy Policy of the Czech Republic*.

In June 1992, during the Conference on “Environment and Development” in Rio de Janeiro, Poland signed the FCCC along with over 150 other countries. Poland ratified the Convention in July 1994, and it became a Party to the Convention on October 26, 1994. Early in 1995, the Polish National Report was provided to the FCCC Secretariat and then presented to the First Conference of Parties in Berlin.

By ratifying the FCCC, Poland accepted the same obligations as the other Annex I countries. The most important of these obligations is “... *returning by the end of the present decade to earlier levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol* ...” (Art. 4 paragraph 2a). The year 1990 was generally indicated as the reference year for the emission stabilization (Art. 4 paragraph 2b). The Countries with Economies in Transition were allowed by the Convention to apply “... *a certain degree of flexibility ... with regard to the historical level of anthropogenic emission of greenhouse gases* ...” (Art. 4 paragraph 6). Poland made use of this possibility and adopted 1988 as the reference year.

As a part of the U.S. Country Studies process, 50 technological GHG abatement options at the sectoral level of the economy were identified and analyzed. The reduction potential of these options totaled 187 teragrams of CO<sub>2</sub> equivalent for the year 2030, which is 30 to 40 percent of Poland’s reference case emissions.

### **The Russian Federation (Russia)**

Russia was re-established as an independent state in 1991. Four years later, GDP had dropped to only 60 percent of 1990 levels. In addition to dramatic increases in prices and unemployment, the economic crisis resulted in a significant decline in energy consumption--primary energy consumption dropped by 25 percent from 1990 to 1995. Electricity consumption and production decreased by 20 percent over the same period. Declines were greatest for thermal power generation, primarily due to sharp reductions in industrial production. Heat production and consumption, on the other hand, have been relatively stable. Despite the reduction in primary energy consumption, the energy intensity of the Russian economy actually increased during the economic crisis, because reductions in output outstripped reductions in energy use.

Russia signed the FCCC in Rio de Janeiro and ratified it in December 1994. In accordance with the procedures of the convention, Russia submitted its first national communication to the FCCC in the autumn of 1995. Russia’s participation in the convention is significant, because it is one of the largest emitters of greenhouse gases in the world. Russia has also established the Interagency Commission for Climate Change Problems, which coordinates climate change policies and programs. The commission monitors compliance with the FCCC, and it studies the economic impact of emissions mitigation programs on the country.

As a result of its economic downturn, Russia will not have to implement special measures to return to its 1990 GHG emissions level. For this reason, the projects described below were not



started as climate change mitigation activities. They focused instead on improving economic efficiency and competitiveness, addressing local and regional environmental problems, and conserving fuel. Because GHG emissions reductions were an ancillary benefit, they were not evaluated directly in the normal course of the projects. Therefore, the authors have had to rely on rather rough assessments when estimating climate protection benefits of the projects studied.

## **Ukraine**

In 1990, the Ukrainian economy took a sharp turn for the worse. Accustomed to heavily subsidized and almost unlimited amounts of fuel and energy from Russia and other Soviet republics, Ukraine has had an unpleasant awakening. Industrial production has continued to decline at rates that, in 1995, reached 50 percent of 1990 levels. GDP actually dipped below 1990 levels in 1995. Inflation reached an annual all-time high of 5000 percent in 1993, but rates have been declining since then. Unemployment rates also grew sharply through the end of 1994.

Energy supply is a painful question in Ukraine, because the country must import about half of the primary energy that it consumes. It relies on a single supplier – Russia – for more than 90 percent of its imported energy needs. Ukraine is also one of the most energy-intensive nations in the world, due to inefficient processes, an economy built upon energy-intensive industries, and a recent inability to utilize its production capacity fully due to economic problems. The end result is a nation that contains 1 percent of the world's population yet consumes 2 percent of the world's energy.

Ukraine is a significant player in global climate change, and it ranked sixth in the world in greenhouse emissions. CO<sub>2</sub> emissions form approximately 90 percent of total greenhouse gas emissions in Ukraine, and the primary source of CO<sub>2</sub> emissions is the energy sector, which contributes 93 to 95 percent of that total.

Ukraine has signed the FCCC, and it has participated in the U.S. Country Studies Program (CSP). Research conducted under the auspices of the CSP suggested that 268Tg of CO<sub>2</sub> could be reduced or offset by the year 2015 simply by using existing measures. Ukraine is currently preparing a national action plan for climate change mitigation for submission to the CSP.